

# U.S. DOE Natural Gas/Renewable Energy Hybrids Workshop

August 21-22, 2001

Richard H. Truly, Director  
National Renewable Energy Laboratory



# Major DOE National Laboratories



- ◆ Defense Program Labs
- Office of Science Labs
- Energy Efficiency and Renewable Energy Lab
- © Environmental Management Lab
- ∪ Fossil Energy Lab

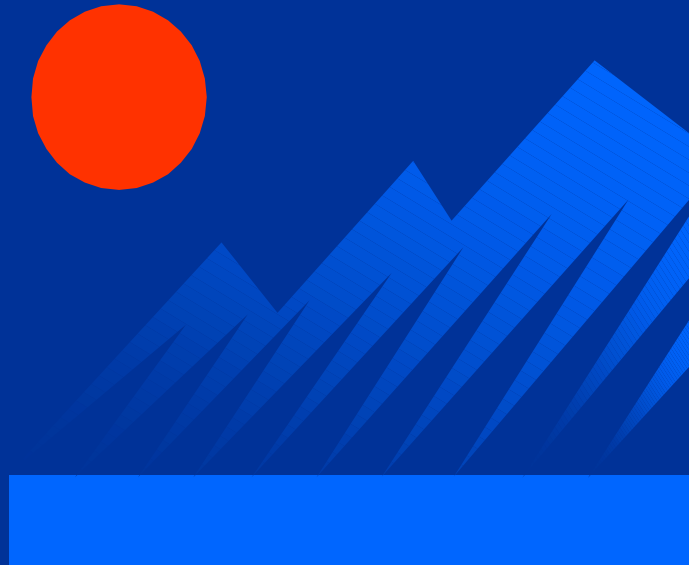
# National Renewable Energy Laboratory

- Only national laboratory ***dedicated*** to renewable energy and energy efficiency R&D
- Research spans fundamental ***science*** to ***technology*** solutions
- ***Collaboration*** with industry and university partners is a hallmark
- Research programs ***linked*** to market opportunities





# National Renewable Energy Laboratory



**Operated for the U.S. Department of Energy by  
Midwest Research Institute • Battelle • Bechtel**

# Major NREL Technology Thrusts

## Supply Side

Wind Energy  
Solar Photovoltaics  
Concentrating Solar Power  
Solar Buildings  
Biomass Power  
Biofuels  
Geothermal Energy  
Hydrogen  
Superconductivity  
Distributed Power



## Demand Side

Hybrid Vehicles  
Fuels Utilization  
Buildings Energy Technology  
Federal Energy Management  
Advanced Industrial Technologies

## Cross Cutting

Basic Energy Science  
Analytical Studies  
International Programs

# South Table Mountain Site



**STM site totals 327 acres, 136 of which can be developed.**

**NREL total: 607 acres**  
(includes National Wind Technology Center)

**Total capital equipment replacement value: \$75M**

**South Table Mountain Site - six facilities at 325,000 ft<sup>2</sup>**  
**NREL total: eight facilities at 376,000 ft<sup>2</sup> \***  
**Facilities replacement value: \$95M**

# National Wind Technology Center



**National Wind Technology Center - two facilities at 52,000 ft<sup>2</sup>**  
**Facilities replacement value: \$20M**

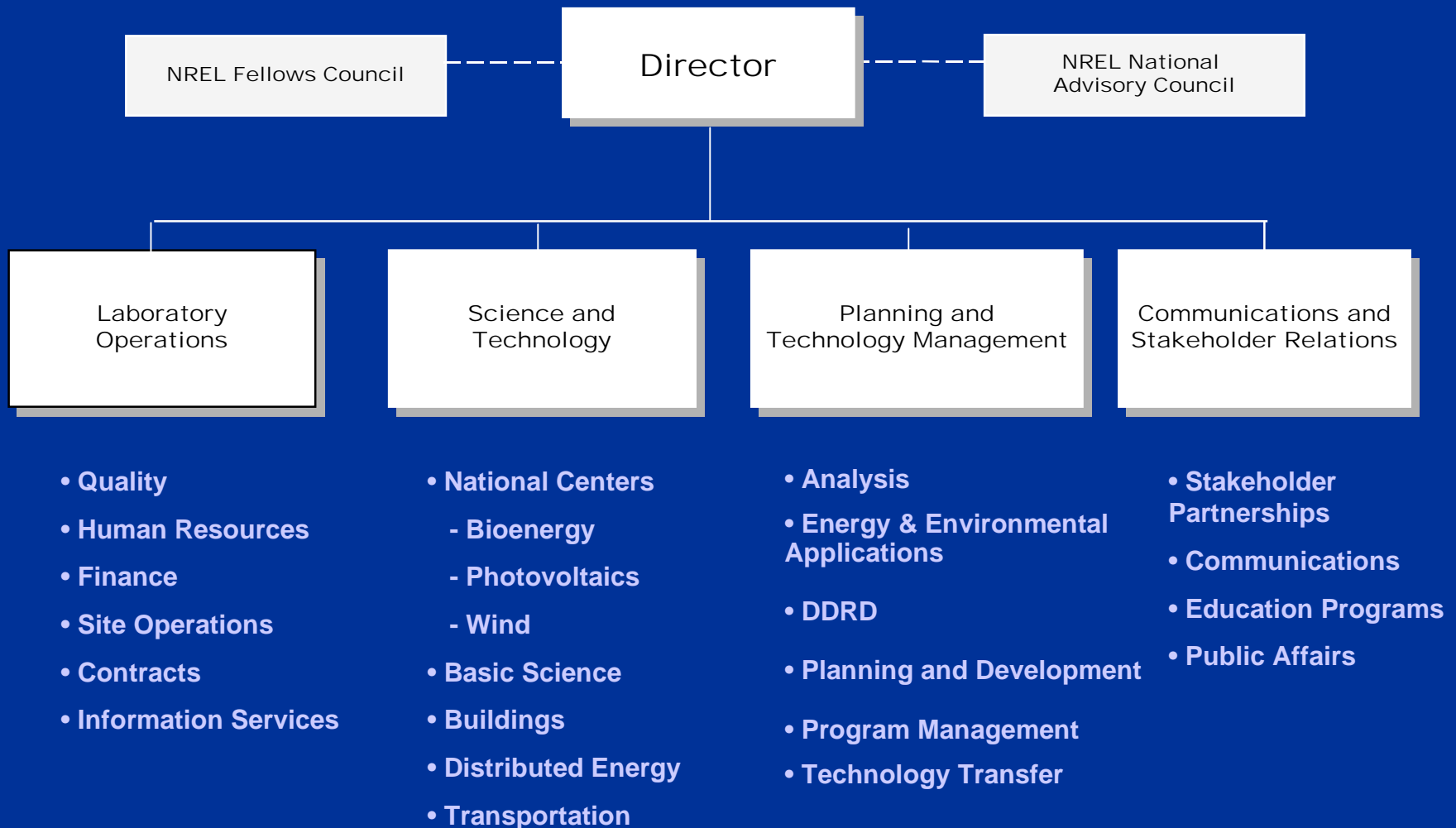
# Leased Facilities



**Denver West Office Park –**  
**Five leased buildings at**  
**approx. 248,000 ft<sup>2</sup>.**  
**Total annual lease cost: \$4.2 million\***

\* includes Denver West, Bldg. 27, Joyce Street, D.C. Office

# NREL Organizational Structure





# NREL National Advisory Council

## Industry

### **Mr. Ray C. Anderson**

Chairman, Interface Corp

### **Mr. Roger Little**

President, Spire Corp; MRI  
Trustee

### **Dr. Alexander MacLachlan**

Former DOE Under Secretary for  
Research and Development  
Management; former DuPont  
Chief Technology Manager

### **Mr. Robert Stempel**

Chairman, Energy Conversion  
Devices; former Chairman GM

### **Mr. Mason Willrich**

Principal, Nth Power  
Technologies, Inc.

## Academia

### **Dr. Jean-Lou Chameau**

Provost, Georgia Institute of  
Technology

### **Dr. George A. Hedge**

Vice Provost for Research,  
Washington State University

### **Father John M. Staudenmaier**

Professor, University of Detroit, Mercy

### **Dr. Jeff Tester**

Professor and Director, MIT Energy  
Lab, Massachusetts Institute of  
Technology

### **Dr. John Trefny**

President, Colorado School of Mines

## At-Large

### **Dr. Richard Balzhiser**

President Emeritus, EPRI

### **Dr. Theodore Bickart**

President Emeritus, Colorado  
School of Mines

### **Dr. Scott S. Brown**

Former Dean, William Jewett Tucker  
Foundation, Dartmouth College

## At-Large (continued)

### **Mr. Walter Cunningham**

Venture Capitalist; former Apollo astronaut

### **Dr. John H. Gibbons**

Former Assistant to the President for  
Science and Technology;  
Former Director, Office of Science and  
Technology Policy

### **Dr. Michal C. Moore**

Commissioner, California Energy  
Commission

### **Dr. Jefferson Seabright**

Vice President for Policy Planning,  
Texaco

### **The Honorable David Skaggs**

Center for Democracy and Citizenship;  
Former member U.S. House of  
Representatives

### **Ms. Victoria Tschinkel**

Environmental Attorney, Landers & Parsons

### **The Honorable James Woolsey**

Shea & Gardner; former Under Secretary of  
the Navy; former Director CIA

# Research Fellows Council



**Art Nozik – Photoelectrochemistry**

**Doug Balcomb – Building Energy Simulation**

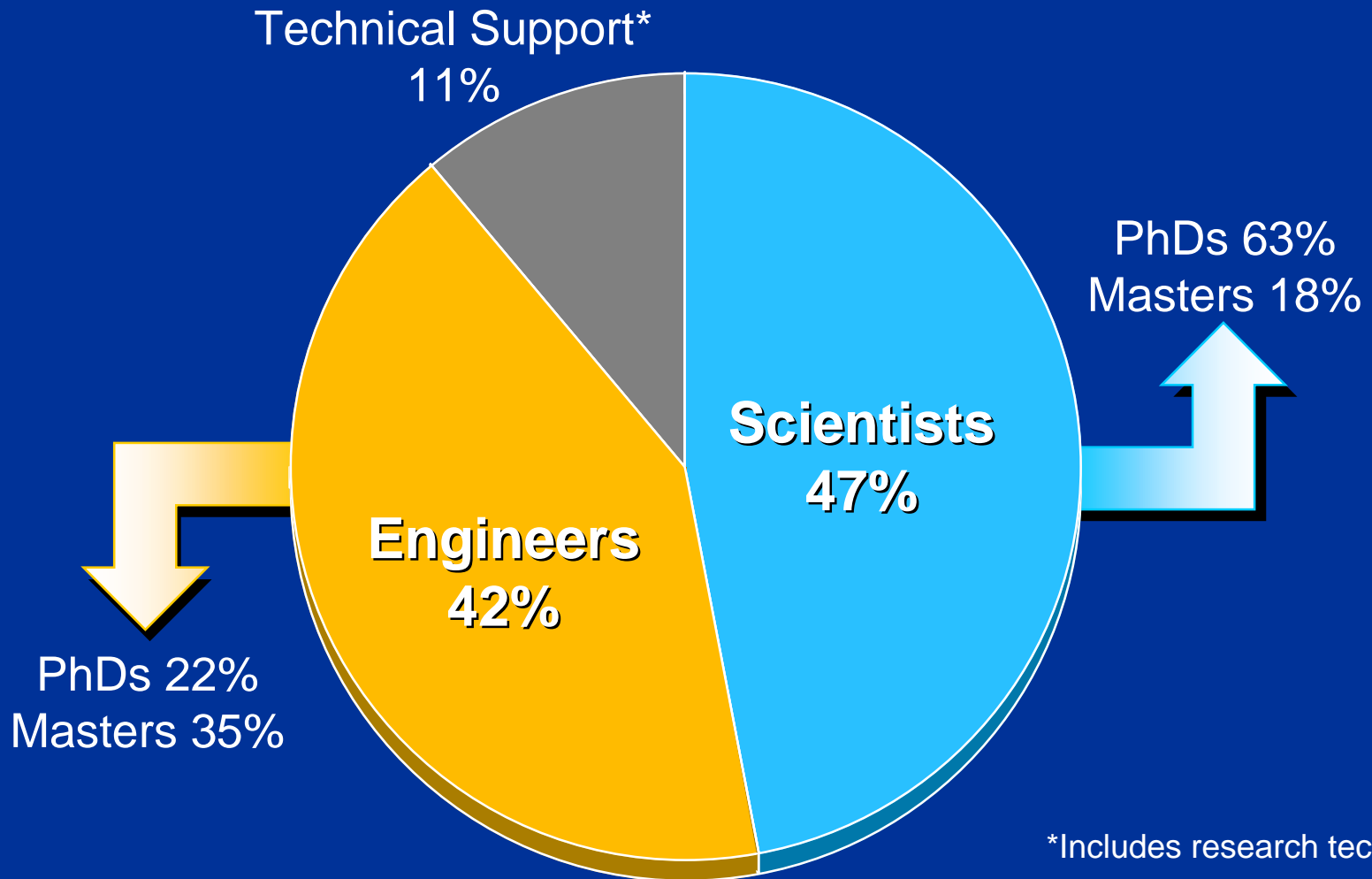
**Tim Coutts – Transparent Conducting Oxides**

**Ralph Overend – Bioenergy Processes**

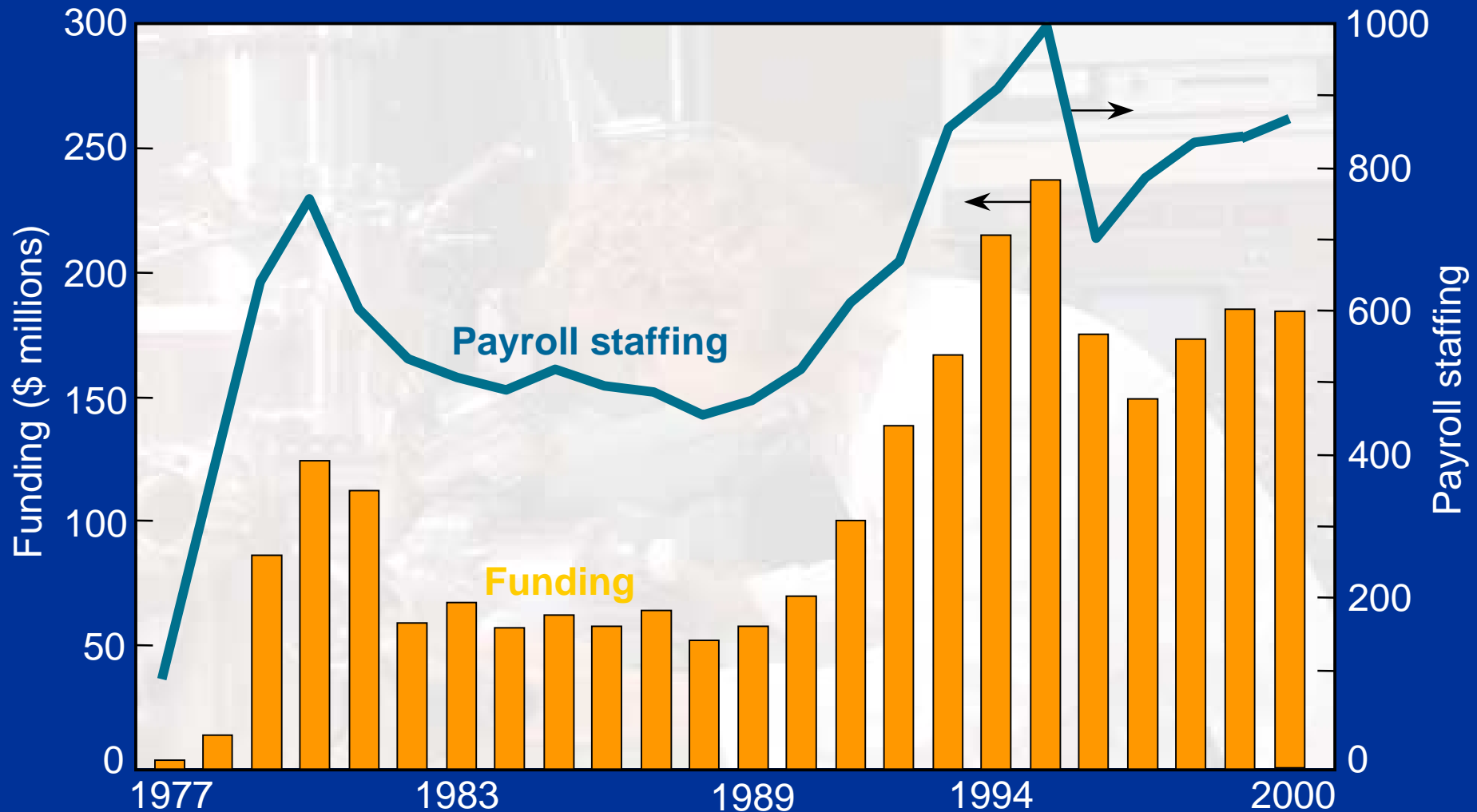
**Alex Zunger – Solid State Theory**

**Dick Ahrenkiel – Electro-optical Measurements**

# NREL Technical Staff Disciplines and Education



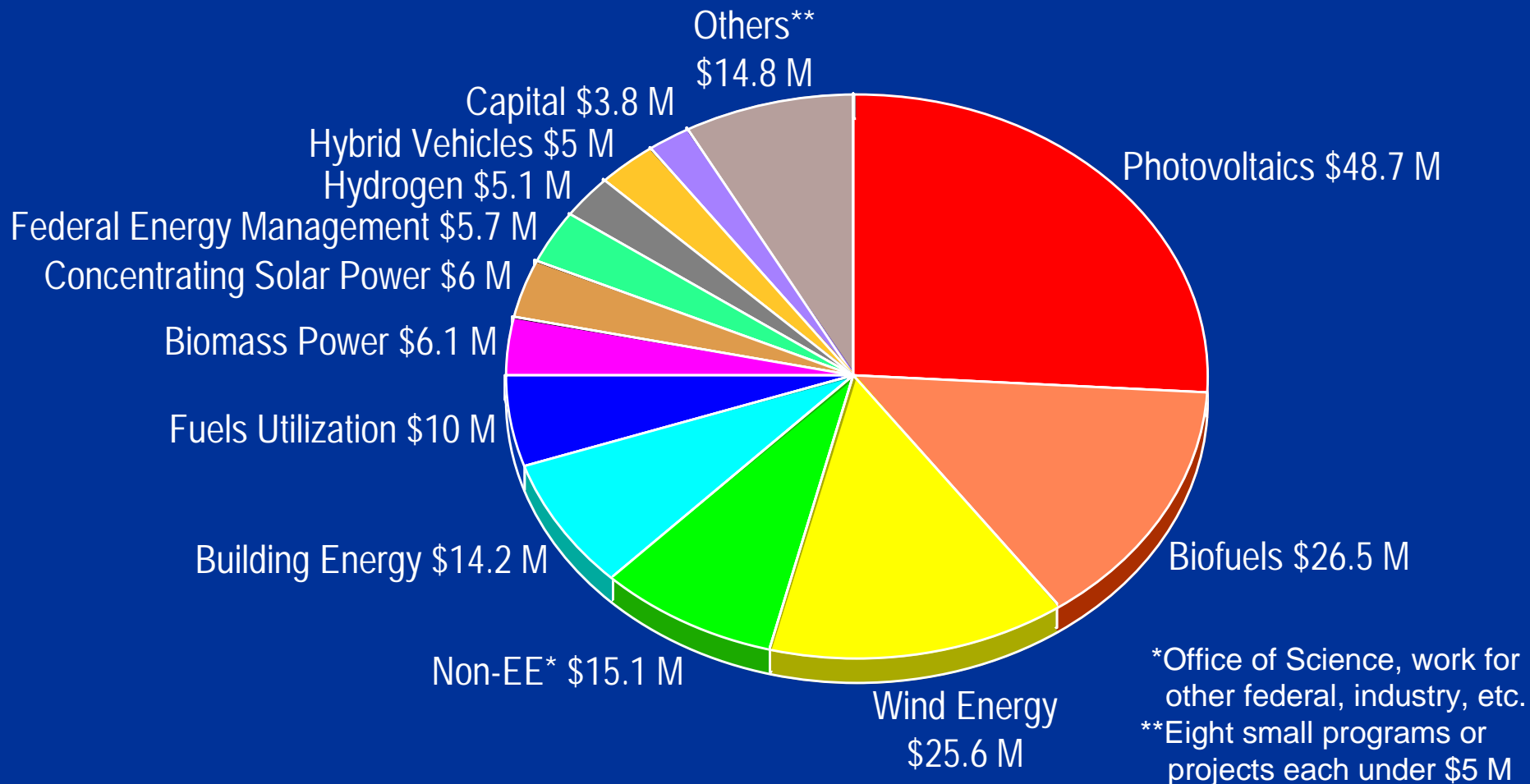
# NREL Funding and Staffing





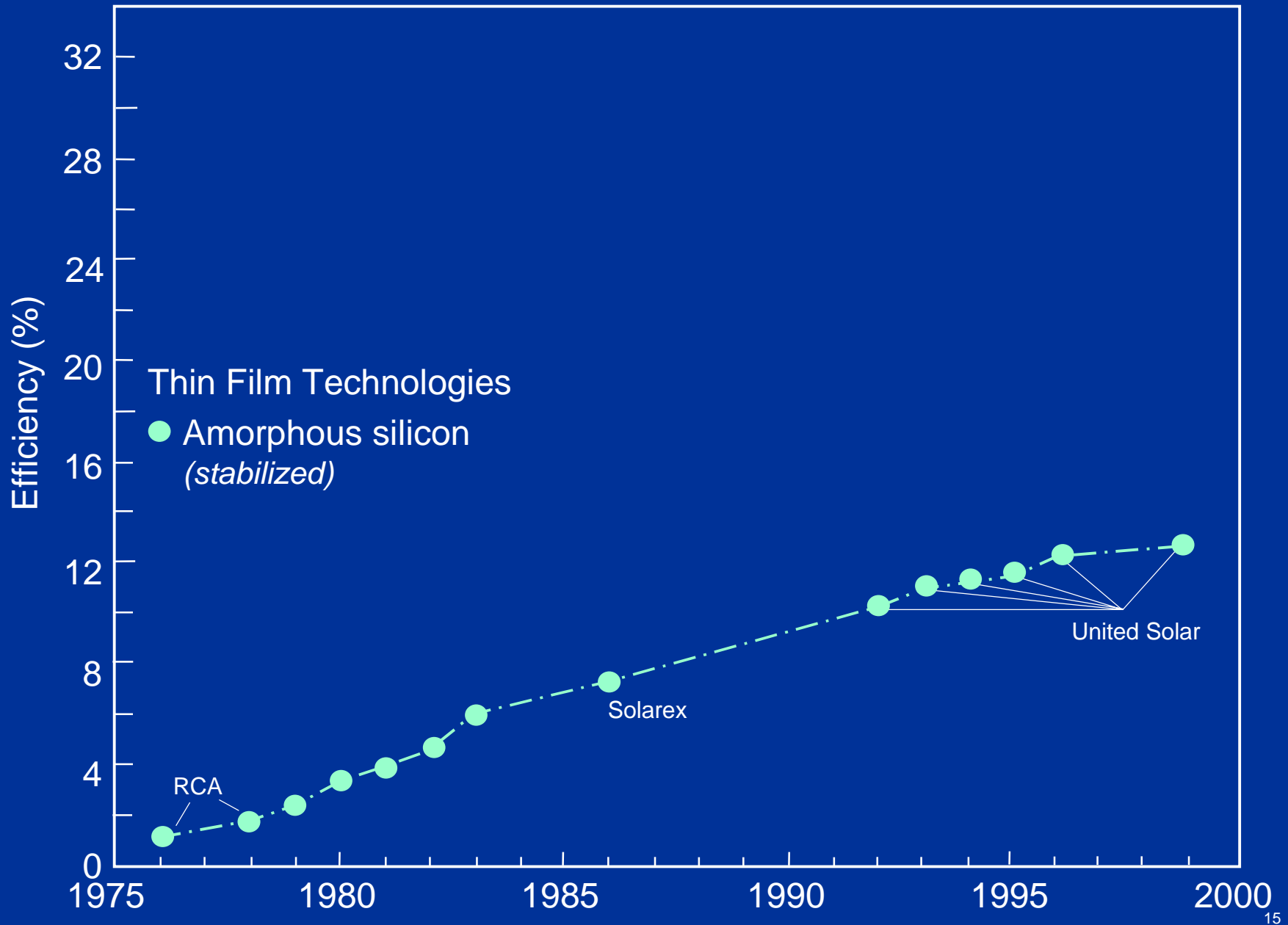
# NREL Funding by Program

FY00 Total: \$186.6 Million

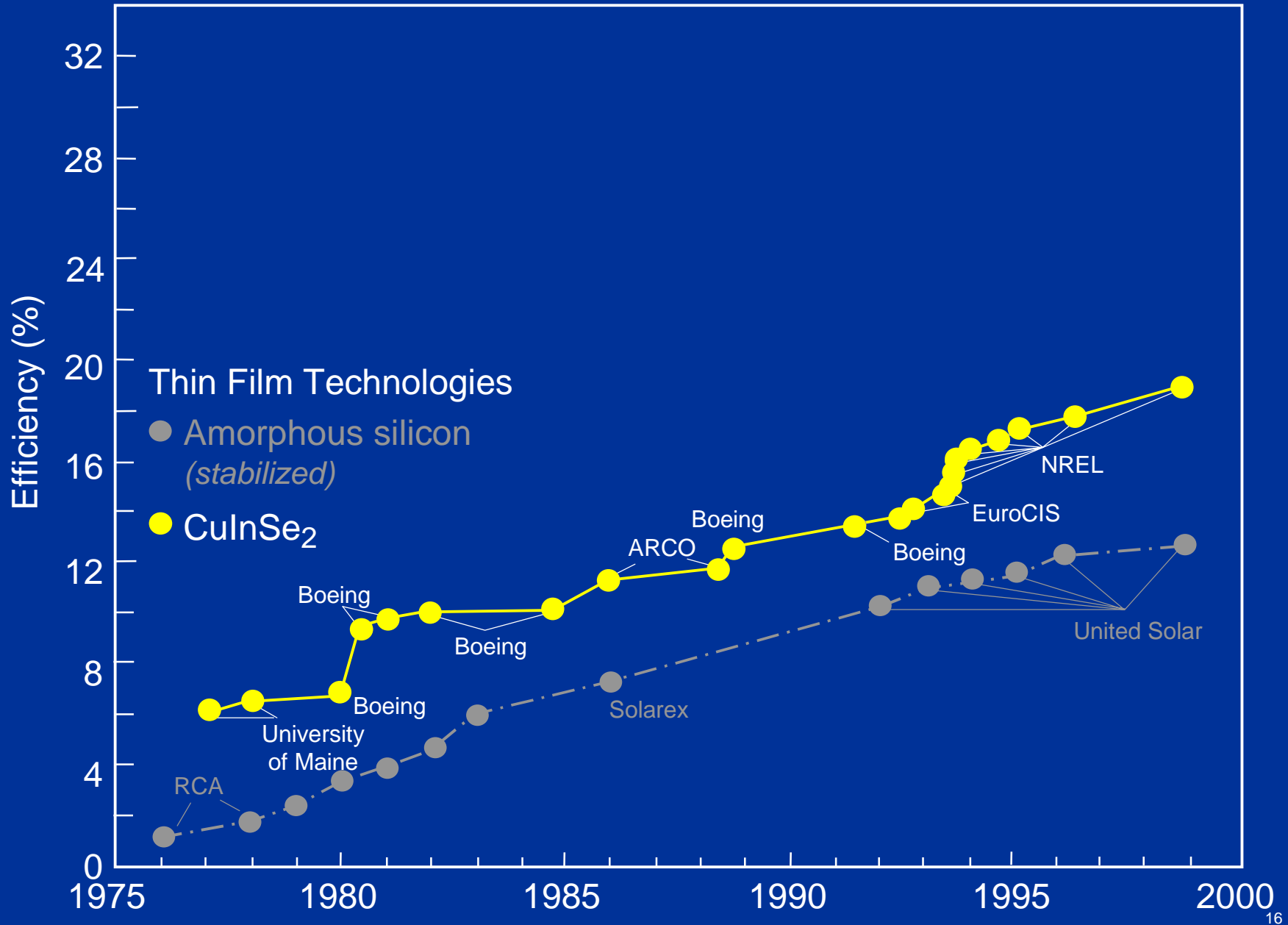


FY01 Projection: \$206 million

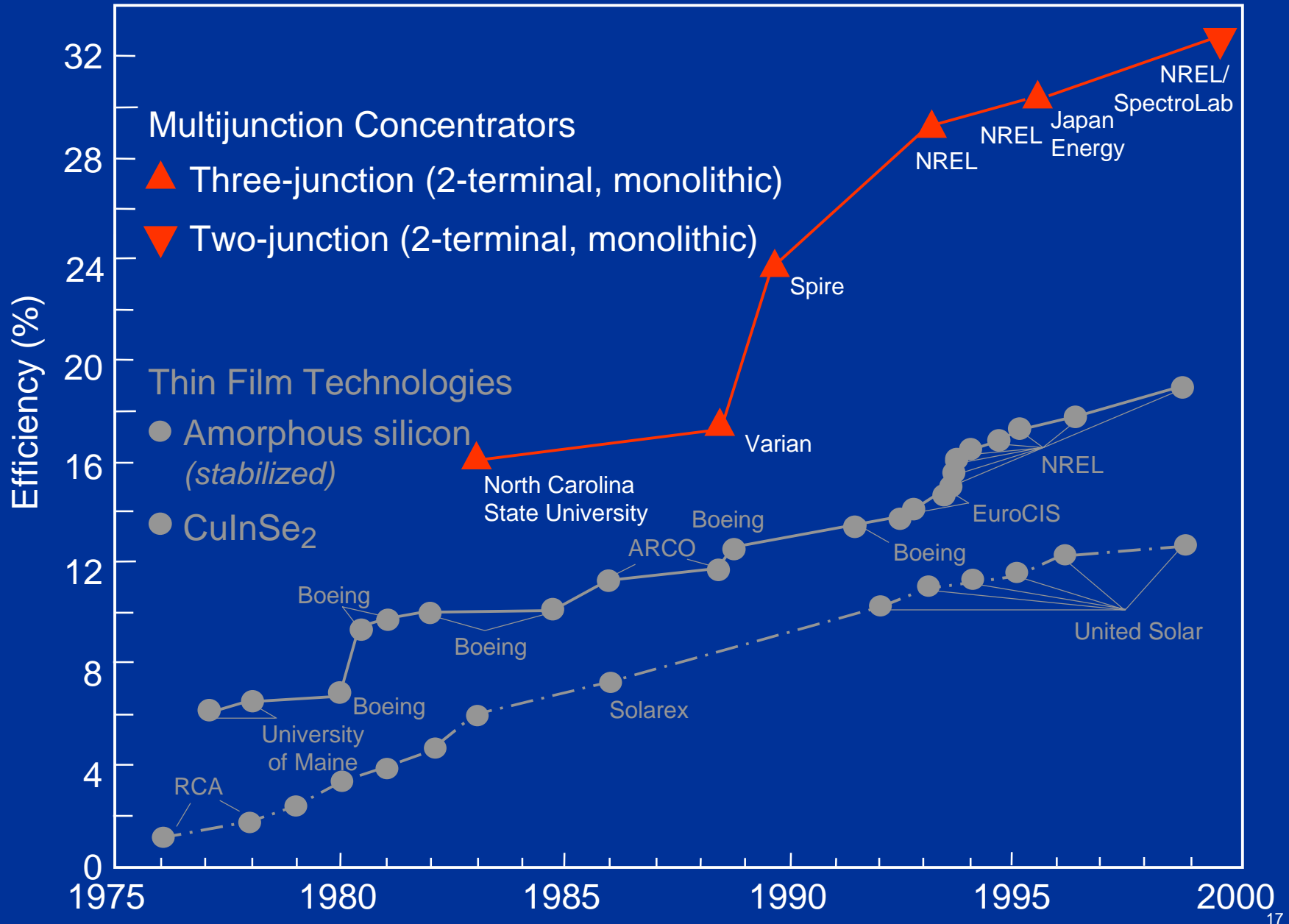
# Best Research-Cell Efficiencies



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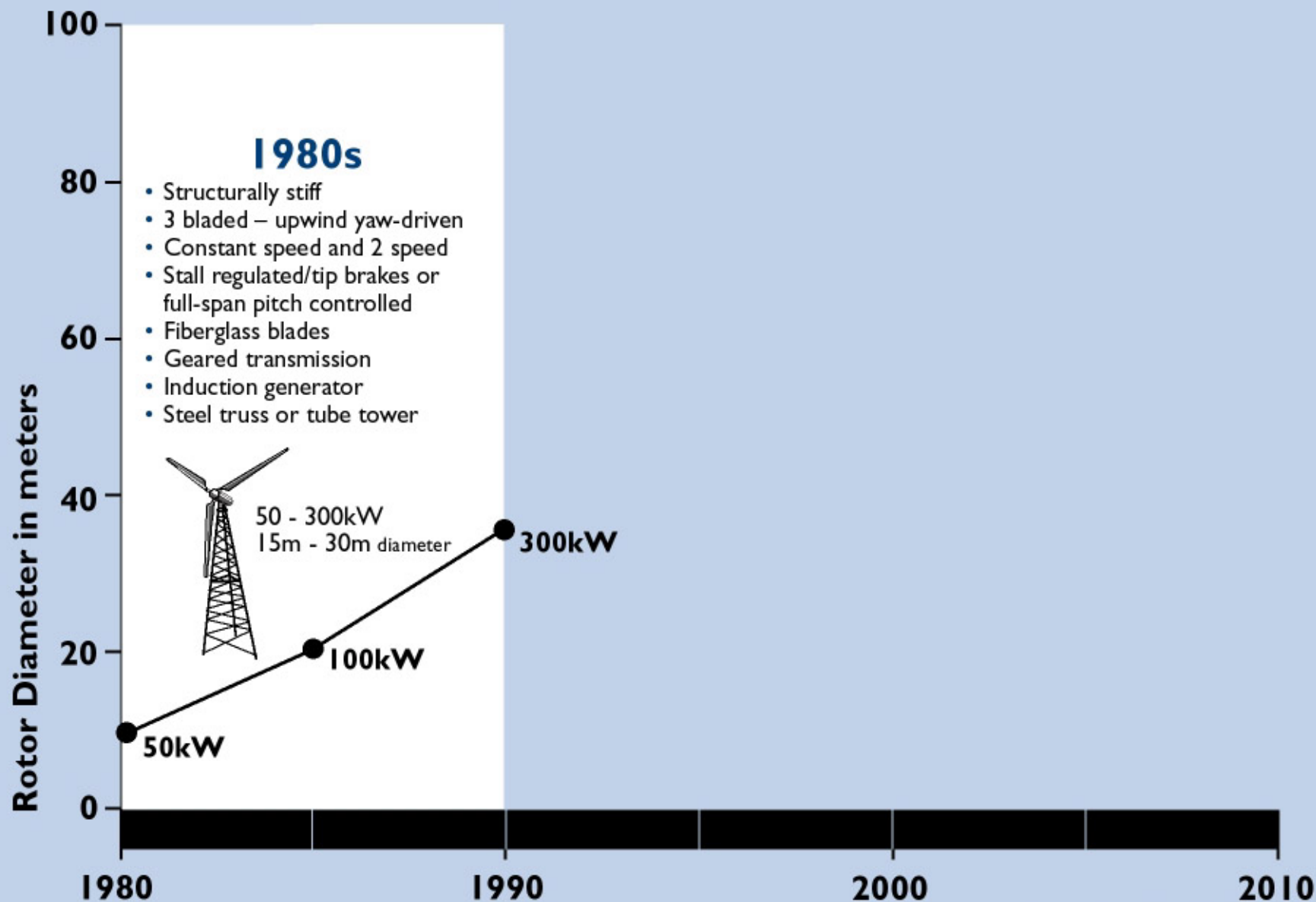


# Best Research-Cell Efficiencies



**NREL**

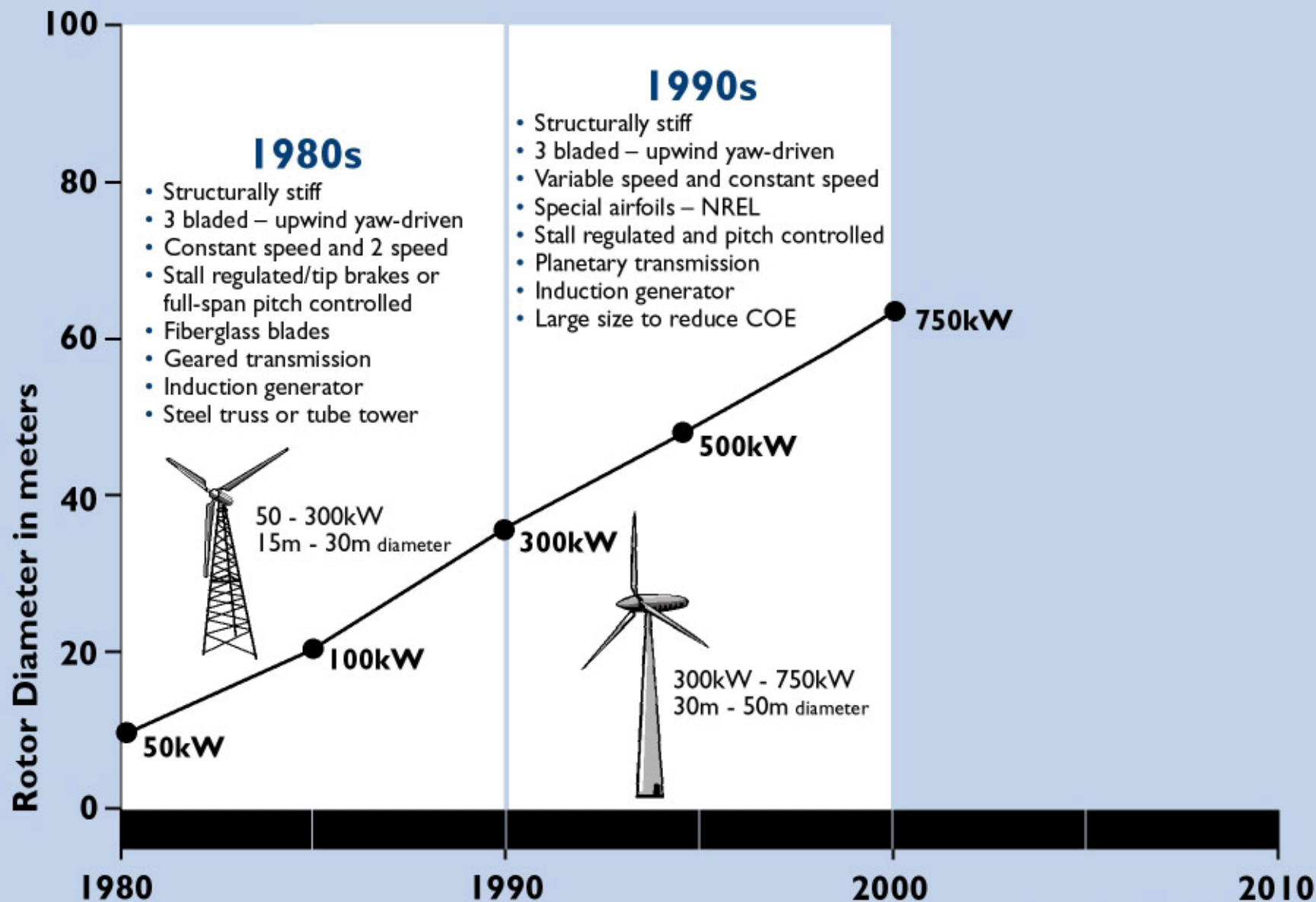
# THE EVOLUTION OF COMMERCIAL U.S. WIND TECHNOLOGY



Source: Thresher & Dodge, Wind Energy Journal 1998

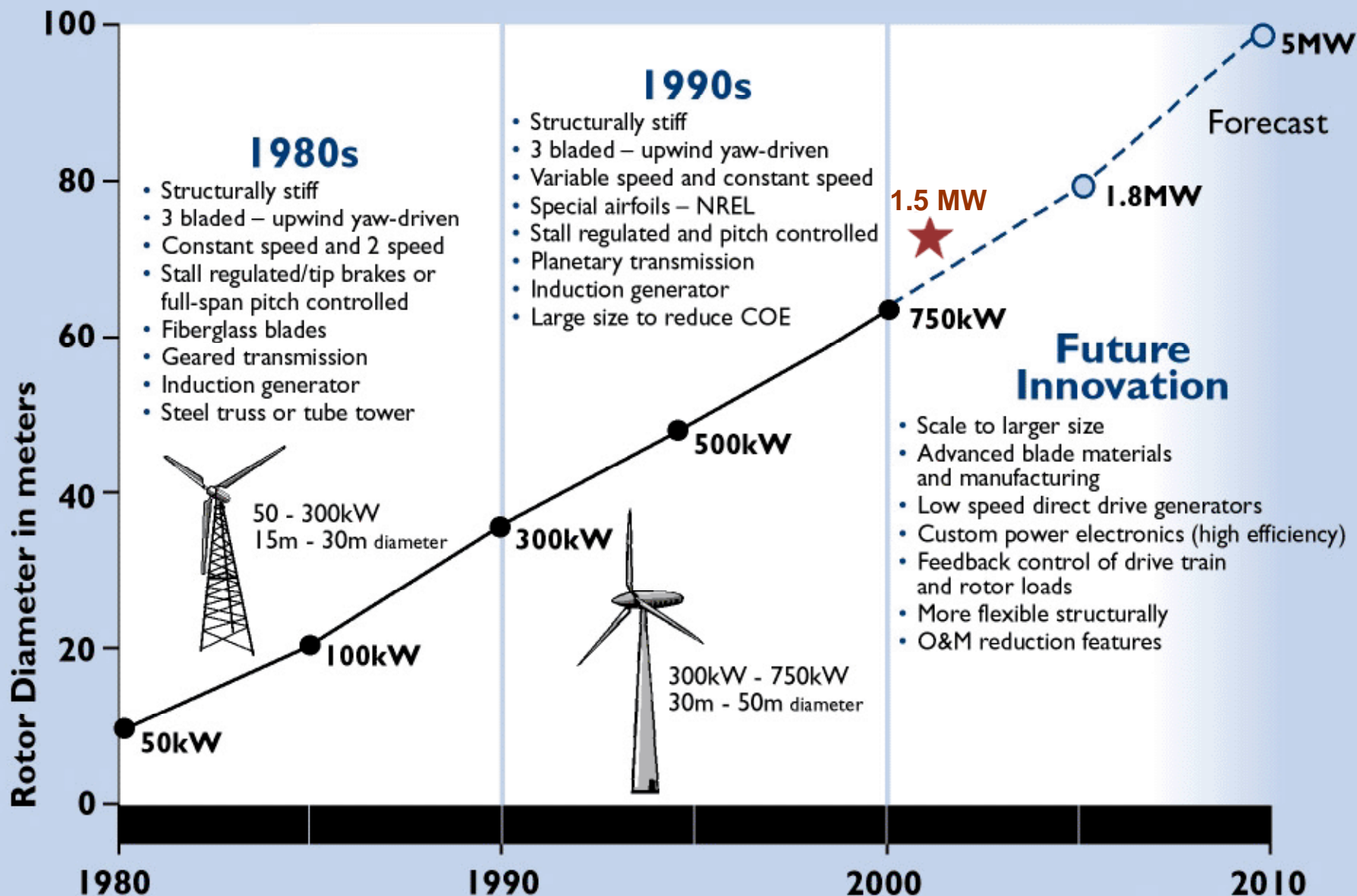
**NREL**

# THE EVOLUTION OF COMMERCIAL U.S. WIND TECHNOLOGY





# THE EVOLUTION OF COMMERCIAL U.S. WIND TECHNOLOGY



# Biomass Research

High  
Throughput  
Biomass  
Gasifier



Ralph  
Overend  
NREL

Milton  
Farris  
FERCO

John  
Irving  
Burlington  
Electric Dept

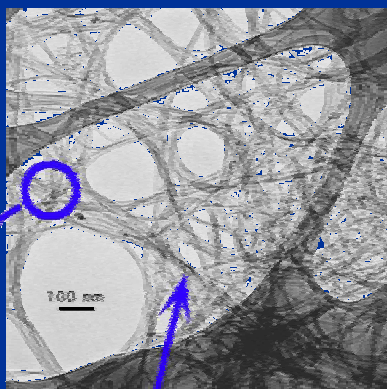
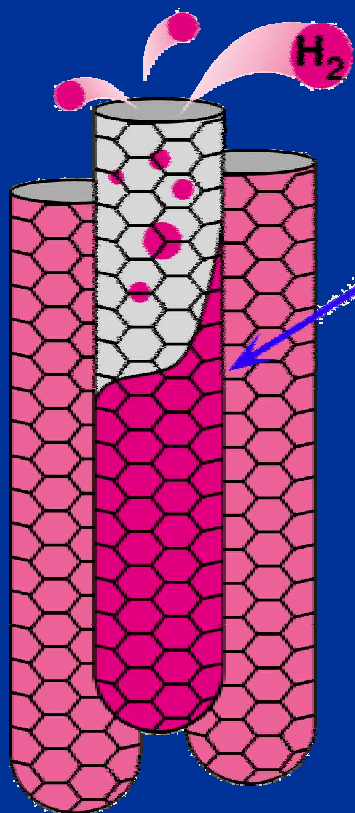
Mark  
Paisley  
Battelle

1998  
R&D  
100  
Award  
Winner

Battelle, Burlington Electric Dept, NREL, and FERCO

# Hydrogen Research

Hydrogen from photoelectrochemical  
splitting of water



**Carbon nanotubes  
for storage**

Mutant algal strains used to split water  
and produce hydrogen in the photobioreactor  
pictured in the background



06225



03595

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